U.S. Dept of Energy's Combined Heat and Power Program Advances for the Industrial End-User

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Texas Technology Showcase

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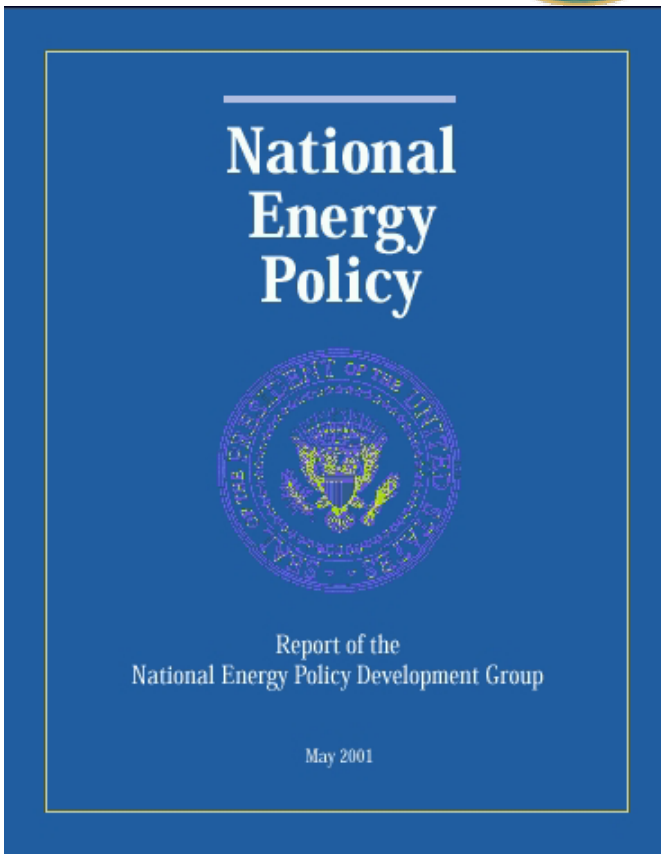
The Federal Role

- Sustain economic growth
- Achieve energy security
- Protect the environment



If left unmet, national electricity needs could threaten international competitiveness, public health and safety, interstate commerce, and national security.

Of the 105 total recommendations...

- 21 affect distributed energy
- 13 affect T&D
- 8 affect international activities
- 17 affect renewable energy

Mission

- Improve the efficiency, environmental outputs, and reliability of generation, delivery and end-use
- High-risk research
  - public/private partnerships
  - Performance based programs
  - Metrics on efficiency, cost, and emissions
- Reduced dependence on foreign oil – fuel flexibility
- Increase security and reliability

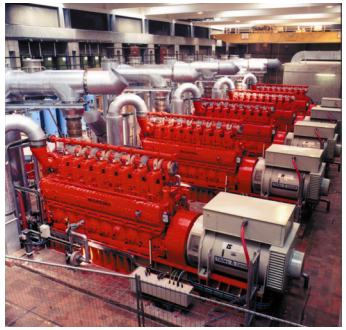
DER Funding Summary

($M)

Program Element	Fiscal Year 2003	Fiscal Year 2004 Request
INTERIOR		
Industrial Gas Turbines	5.0	3.0
Microturbines	7.0	7.0
Reciprocating Engines	12.0	9.0
Technology Base	8.26	8.26
Thermally Activated Technologies	7.66	4.66
Fuel Flexibility (oil)	0.750	0
Industrial DG/High Tech/Controls	8.34	7.34
Packaged Systems R&D/CHP	12.0	12.0
TOTAL INTERIOR	61.01	51.26
EWD		
Transmission Reliability		10.72
Distribution & Interconnection		7.25
Energy Storage		5.0
Superconductivity		47.8
TOTAL EWD	85.0	70.77

Program Portfolio

Fuel



Technology Development: Microturbines, reciprocating engines, fuel cells, materials, storage

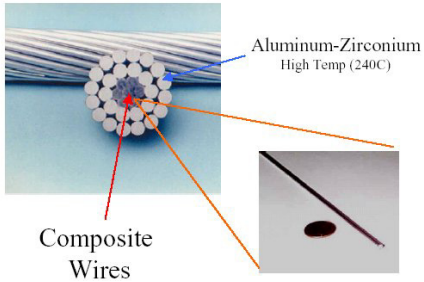
Technology Packages: Integrated CHP systems, chillers, desiccants

End-use Integration: Demand management, controls, sensors

Electric and Gas Integration: Load management, sensitive loads, power electronics

Distribution System: Load management, power parks, microgrids, storage, ups, control, DC grids

Composite Conductor



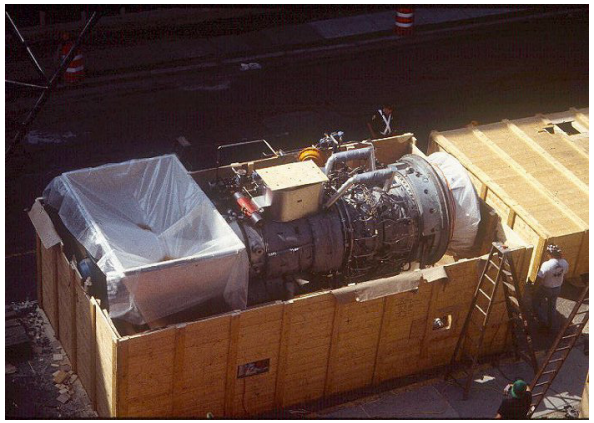
Transmission System: wire materials, tools

The CHP Challenge Goal

1998

46 GW

By 2010, double the amount of CHP capacity in the United States

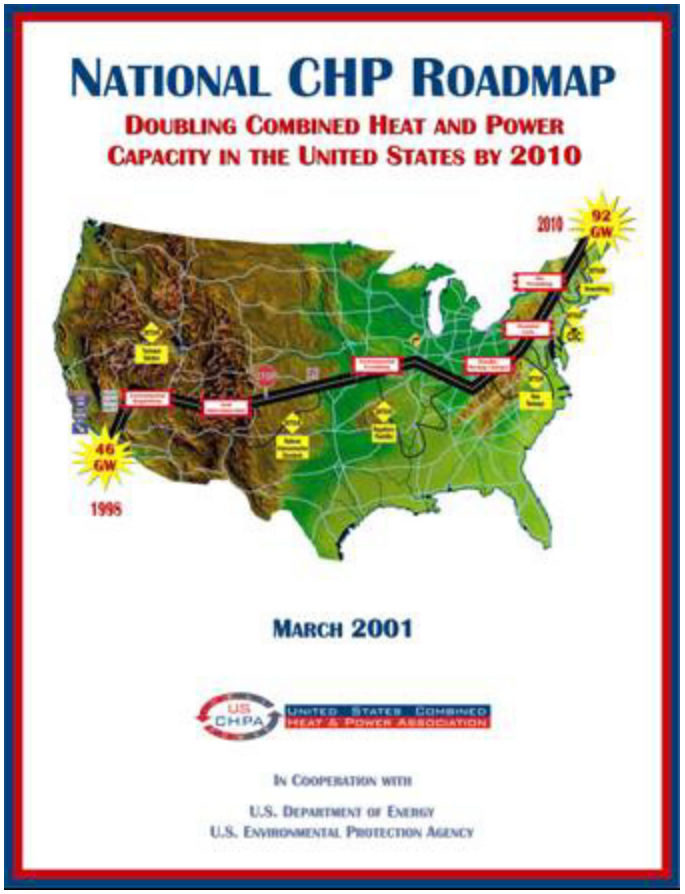


2010

92 GW

Activities

Our CHP activities are guided by the actions identified in the National CHP Roadmap as those items required of us to meet the CHP Goal



- Raise CHP Awareness
- Eliminate Regulatory and Institutional Barriers
- Develop CHP Markets and Technologies

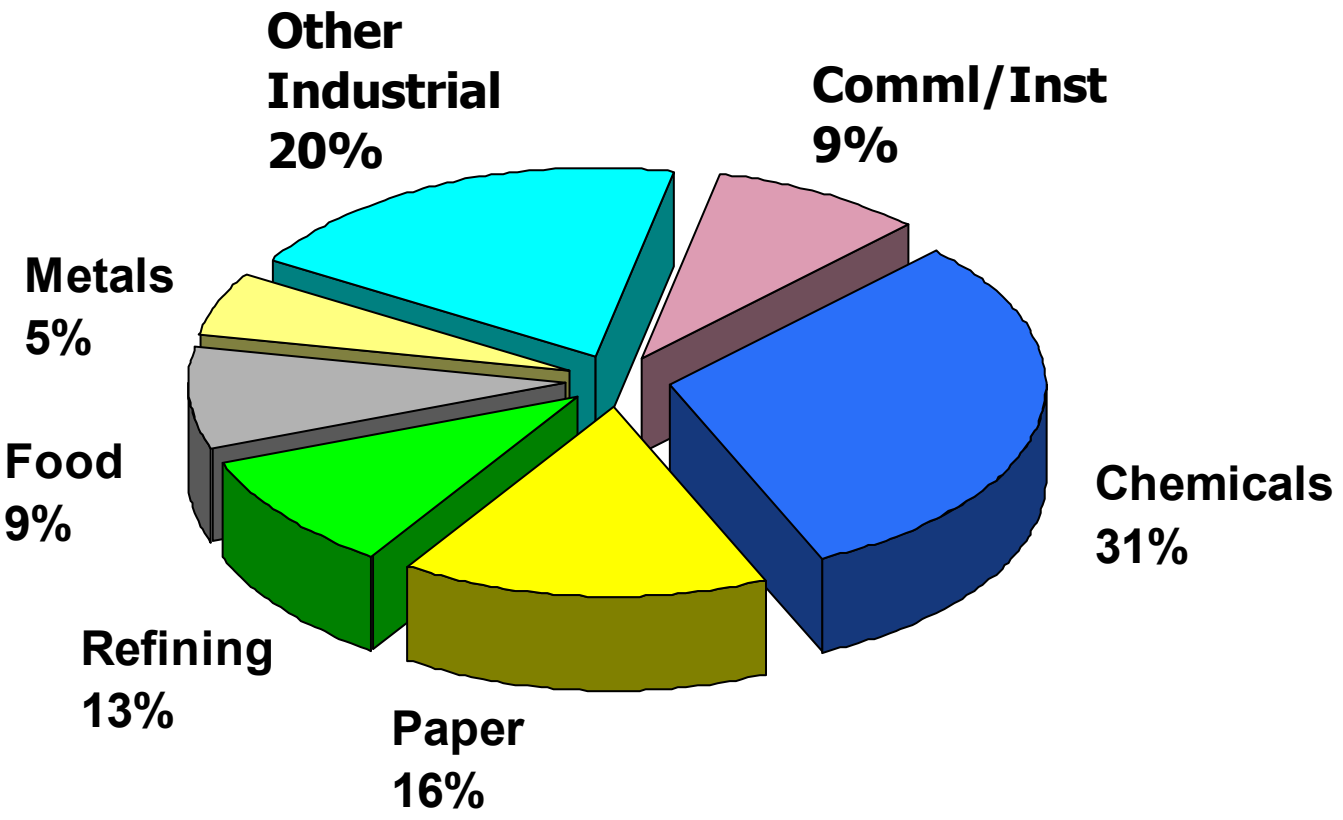
CHP Target Markets

The goal is to increase each market by adding:

- 27 GW Industrial CHP
- 8 GW Building Cooling, Heating and Power (packaged systems)
- 8 GW District Energy
- 5 GW CHP in federal facilities

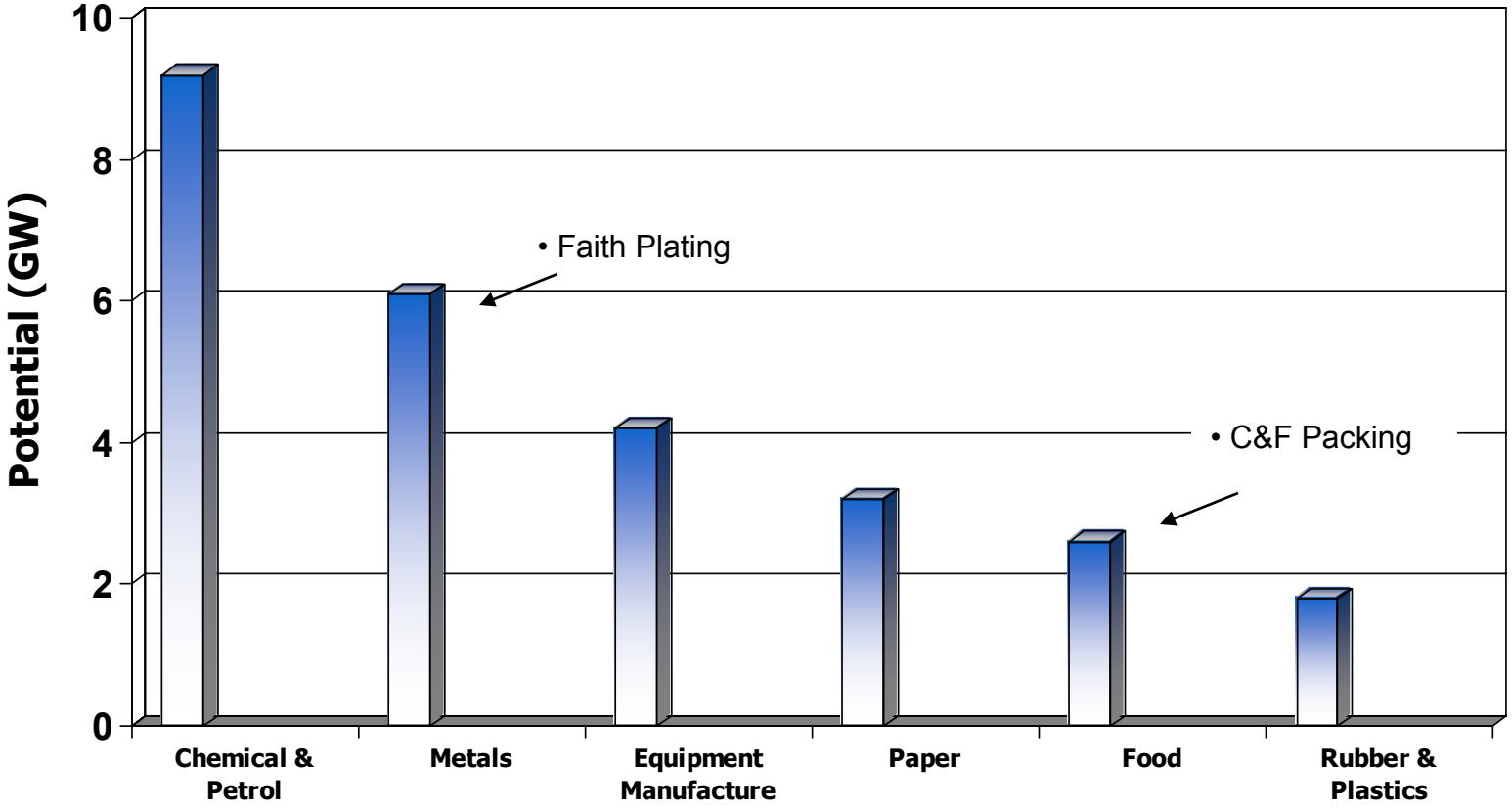
U.S. CHP Installations

52,800 MW – 1999



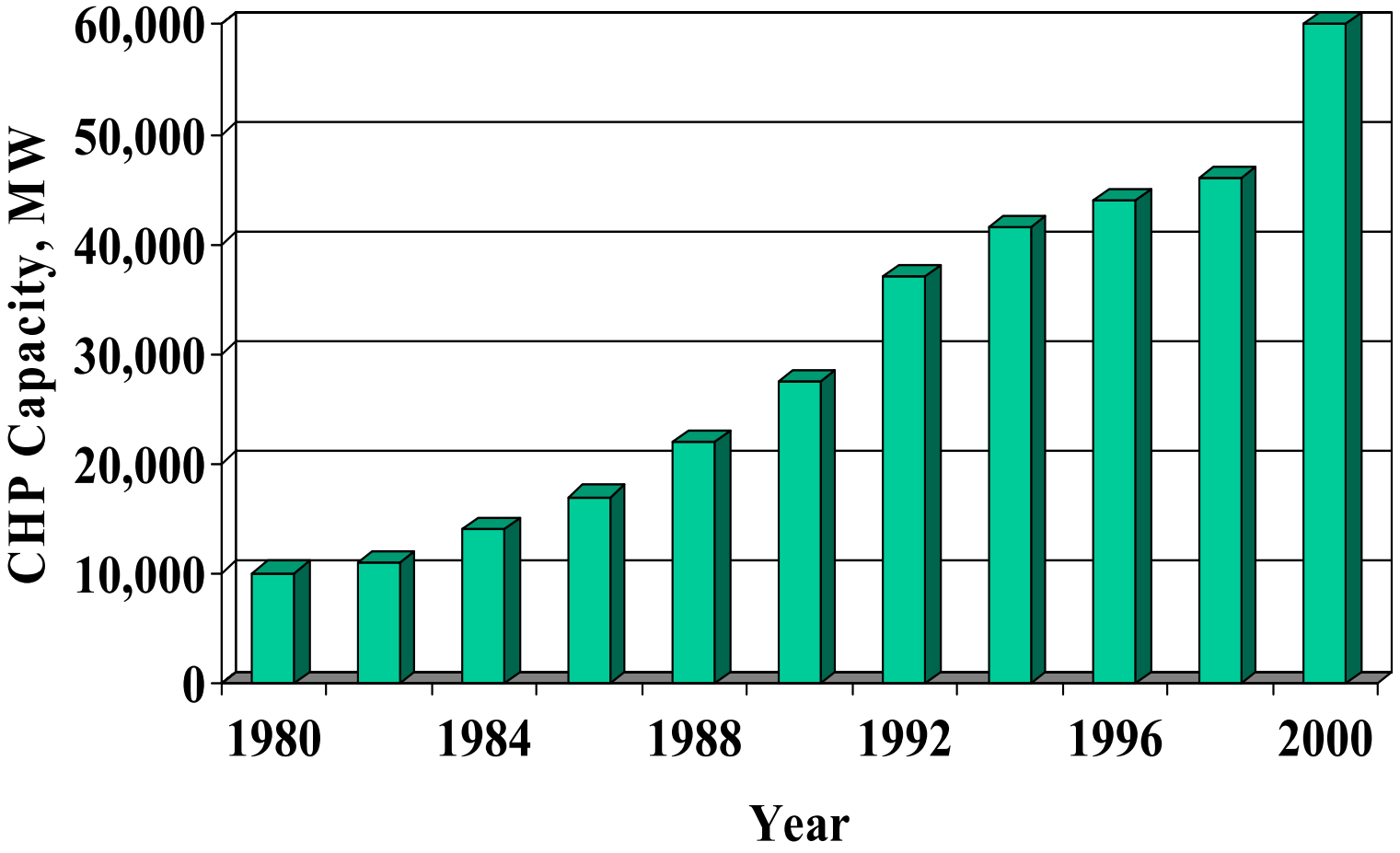
Source: U.S. DOE-EIA and Onsite-Sycom

Industrial sector projects develop CHP potential



Data from Resource Dynamics, May 2002, *Draft Cooling, Heating and Power for Industry: A Market Assessment*

CHP Development in the United States



Activities Directly Supporting the Advancement of the CHP Goal

- Improved Generation and Heat Utilization
- Integrated Energy Systems
- CHP Outreach and Integration Activities
- Analysis and Evaluation Tools

Distributed Gas Fired Technologies

Microturbines

2000
- $900-$1,200/kW
- 17-30% Efficiency
- Double digit ppm NO_x

2007
- Cost competitive with the market
- 40% Efficiency

2010
- Single digit ppm NO_x

"Prime Movers"

Gas Turbines

1992
- 29% efficiency
- Double digit NO_x
- $600/kW

2001
- 38% Efficiency
- Single digit NO_x
- $400/kW

2010
- Cost competitive with the market
- <5 ppm NO_x

Reciprocating Engines

2000
- $300-$400/kW
- 25-40% Efficiency
- 2-3 grams/kWh NO_x

2007
- Cost competitive with the market
- 50% Efficiency
- < 0.15 grams/kWh NO_x

$19 Million Awarded For Integrated Energy Systems

- Seven industry teams awarded contracts to research, develop and test “First Generation” Integrated Energy Systems .

- Distributed Energy Resource (DER) systems are highly efficient with low emissions.
  - Allows generation (< 10 MW) close to the point of use
  - Combined with thermal recovery to heat or cool nearby buildings increasing efficiency from 32-56% to 70-85%
  - Improve energy security – electric reliability
  - Reduce emissions of carbon dioxide and priority pollutants

- More than 43% Industry cost-sharing (over $31 million total project costs).

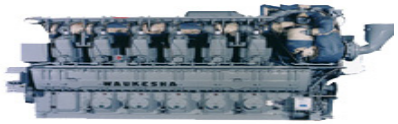
Large Scale Modular IES

Honeywell Laboratories

5 MW turbine generator integrated with 1,000 RT waste-heat absorption chiller at Fort Bragg

Burns and McDonnell

4.6MW turbine generator integrated with 2,000 RT of waste-heat and 500 RT of waste/direct fired absorption cooling with greater than 70% efficiency.



Gas Technology Institute

Engine generator (290 kW to 770 kW) integrated with absorption chillers.

Small Scale Modular IES (30-600kW)

Capstone

30-60kW microturbines integrated with absorption chillers for space cooling in buildings

NiSource

Multiple microturbines integrated with absorption chillers, desiccant units, and control system developed as standardiz model for Hotel/Motel

Hilton

Industrial Partners Developing Small Scale Modular IES (30-600kW)

Ingersoll Rand

70kW microturbine integrated with ammonia-water absorption refrigeration for space conditioning and refrigeration

UTRC

-combination of off the shelf components for packaged system within 1 year

-Capstone 60 Microturbines coupled with Carrier absorption chillers. Also considering refrigeration, desiccants, and thermal storage systems

Distributed Generation in the Industrial Sector

- $3M R&D on High-Value Commercial and Industry DER/CHP Application
- Demonstrate DER/CHP benefits in the market place (9 projects about half are CHP)
- Facilitate acceptance in end-use sectors
- Develop decision/design tools and conduct feasibility studies
- Demonstrate and quantify value to end-use customers
- Document case studies for education and outreach

Energy Solutions Center
(formerly Industrial Center)

- Market Assessment for Industrial CHP for systems up to 1MW (projected 11GW potential)
  - Develop integrated CHP processes for ***replicable*** systems
  - Select up to 5 leading thermal processes that could be easily integrated into CHP systems and offered the largest energy savings potential—Two underway
- Industrial CHP demonstrations and "Applications Manual" to help customers select more efficient, more reliable, and lower cost systems

energysolutionscenter.org

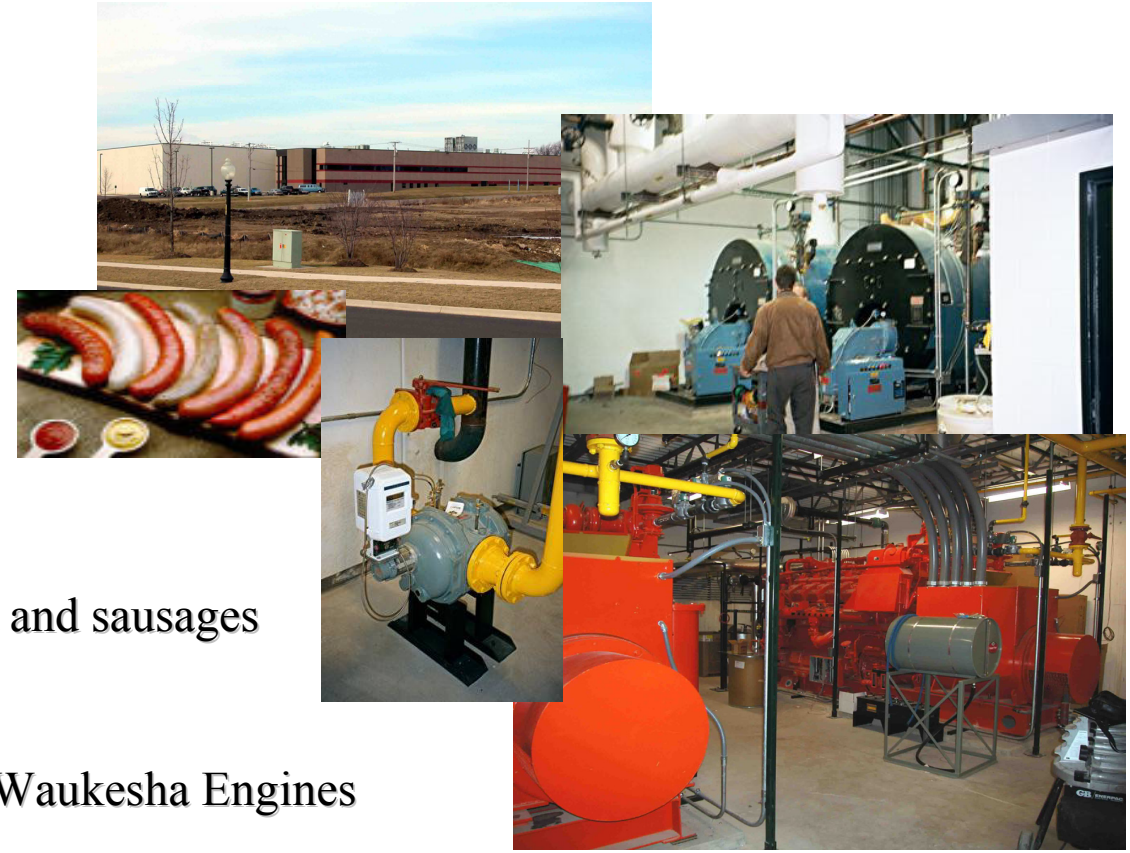
FAITH PLATING

DEMONSTRATION

Site:	Los Angeles, CA
Product:	Chrome plating shop
Cons. Utility:	Southern California Gas Company
Power Gen.:	Four 30 kW Capstone micro-turbines
Heat Rec.:	Hot water for plating tank heating
Operation:	base loaded
Status:	Data collection started June 2002
Comments:	Customer interested in using waste heat from the Unifin heater for sludge drying for maximum heat very – other plating companies interested

C & F Packing

DEMONSTRATION



Site:	Lake Villa, IL
Product:	Processed meat and sausages
Cons. Utility:	Nicor Gas
Power Gen.:	Two 1125 kW Waukesha Engines
Heat Rec.:	Boiler feed-water preheating from one engine jacket
Operation:	9 am to 10 pm
Status:	New facility commissioned May 2002, Power Generation data collection started June 2002, CHP mode started September 2002
Comments:	Rate response driven operation; steam used in direct contact steamers; potential to expand heat utilization

Regional Application Centers

University of Illinois-Chicago: Midwest Regional CHP Applications Center

- facilitate CHP projects, technical assistance
- region-specific information, application knowledge

www.chpcentermw.org/home.html

- Guidebook
- Lessons learned in setting up Application Center – to be used by future centers

Regional CHP Initiatives

- Midwest – The First, The Model
  - Subcommittees on Market Development, Interconnection, Permitting, Policy, Education and Outreach
  - Linked with Mid-west CHP Application Center
- Northeast – Using the Midwest Model for their regional initiative and possible application center
- Southeast –Held their first planning meeting (May)
  - Tremendous enthusiasm and interest
- Northwest – Have begun their regional initiative and held first meeting
- Southwest – Held planning meeting in May and have expressed interest in forming a regional initiative
- Central – Identifying Steering Committee and potential "champion(s.)" Clarifying the "region(s)"
- Mid-Atlantic
  - Distributed Generation Coalition – Plan to incorporate more CHP

State Energy Program

- Current CHP Topic is Regional Combined Cooling, Heating, and Power Application Centers
- SEP Solicitation is currently open

  CLOSES MAY 9, 2003
- Web site: **http://e-center.doe.gov**

Case Studies and Feasibility Studies

- ORNL Assessment Methodology for DER (includes case studies)
- IDEA University/College Case Studies and Lessons Learned
- CHP Market Potential
  - California (EnergyNexus Group)
  - New York (EnergyNexus Group)
  - Federal Facilities (ORNL)
  - College/University (IDEA/ORNL)
  - National (EnergyNexus Group)
- Case Studies available through DOE Web Site
- HUD Readings in Community Energy Systems
- DOE CHP Solicitation anticipated to be awarded this calendar year

Eliminating Regulatory and Institutional Barriers

- IEEE-NREL developing uniform interconnect standards
- Model rule for air emissions from smaller scale electric generation resources that will include offsets for CHP
- Texas DG Emissions Limit Analysis
- Environmental Barriers Report
- Interagency Agreement with EPA on DER/CHP Issues
- Supporting efforts to revise tax codes/depreciation schedules for CHP

Texas DG Emissions Limit Analysis

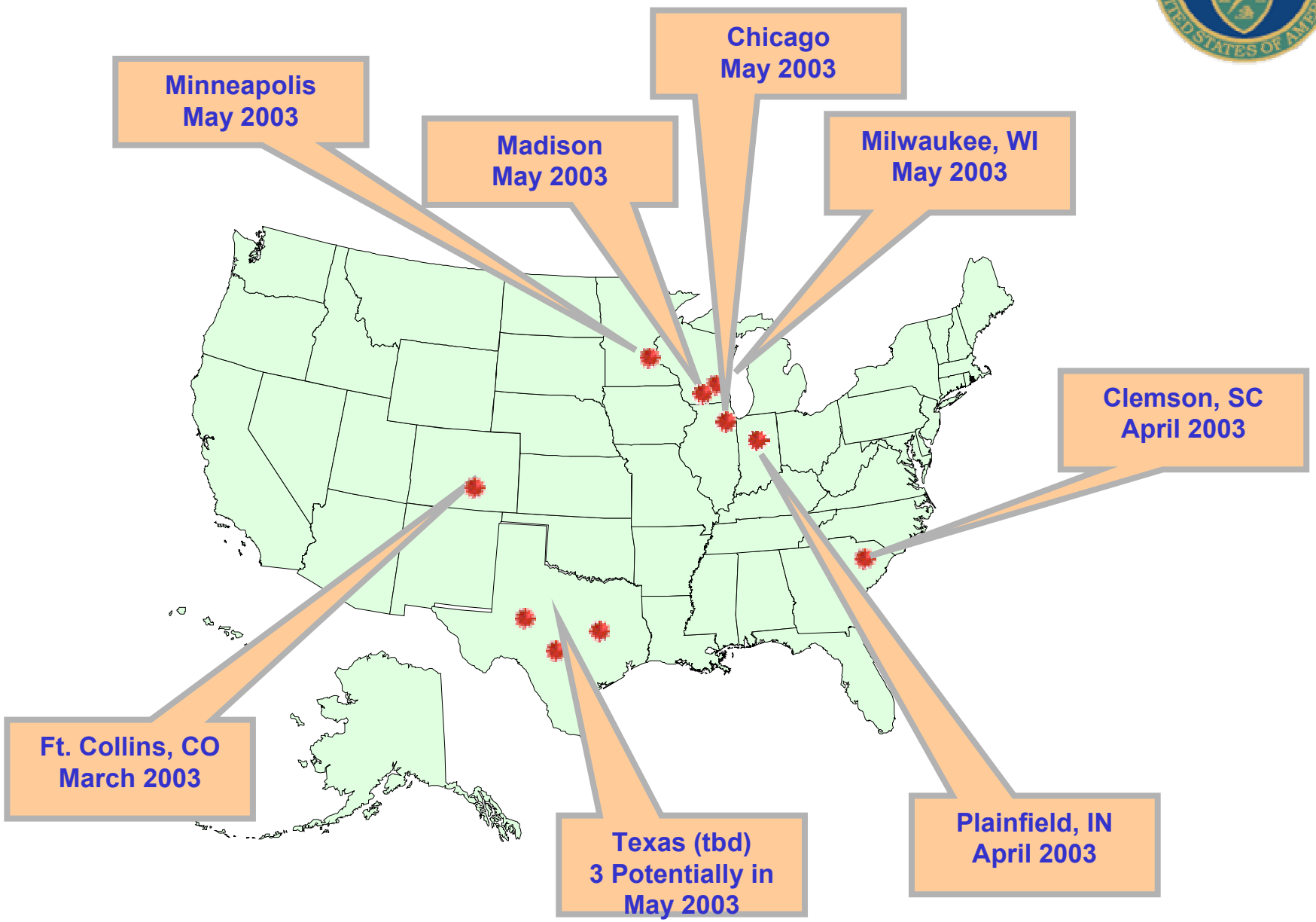
- Evaluate the impact of various NOx emissions limits on DG applications in 2002, 2006, 2010
- 5 DG technologies in 7 specific applications
- Relies on manufacturer's expectation of future cost and performance
- Potential market for DG in Texas is substantial

Available on our Web Site

Building Codes and Standards DER Road Shows

- One day, eight-hour session with State Certification of Inspectors
- Purpose: to introduce local building and fire code inspectors to DER technologies with a “hands-on” experience
- Manufacturers present on their product, the installation/permitting process, with or without specific reference
- Alt. fuels and electrical interconnection may also be covered
- State PUC, energy office, and EPA regulators generally participate as well.
- IMPORTANT – Local regulators indicate which technologies, applications and fuel sources are of interest. Agenda is not fixed in advance.

Upcoming DER Road Shows



Assessment Survey of Computer Software Tools for Evaluation of DG and CHP

- Survey study will characterize available tools' functionality, availability, and cost
- Survey identifies and summarizes available software that evaluates or helps design DER/CHP applications for buildings, campuses, and industry
- Packages must include economic as well as technical elements

Industrial Software Screening Tools Summary

Software Name	Primary Application	Cost	Reference
Cogeneration Ready Reckoner	Industrial CHP	Free	www.eere.energy.gov/der/chp/chp-eval2.html or www.industry.gov.au
Process Heating Screening Tool *	Industrial CHP (Direct process heat applications)	Free	Under development
RECIPRO	CHP using recip engines	$1,500.	www.thermoflow.com/
PDE	Industrial CHP using gas turbines	$3,000.	www.thermoflow.com/
HeatMap CHP	Industrial CHP/ District Energy	$4,000	www.energy.wsu.edu/software/HEATMAP/
GT Pro	Industrial CHP using gas turbines	$7,000.	www.thermoflow.com/
SOAPP-CT.25	Industrial CHP using gas turbines	$7,500	www.soapp.com/soapp/dg/

* Under development

Conclusions

- DOE's CHP activities address needs from the National CHP Roadmap
- CHP is a critical component of the National Energy Plan
- CHP is integrated with most of our distributed energy efforts
- CHP increases efficiencies and reduces emissions of many distributed energy systems
- States/regions play critical role in eliminating the barriers to and developing the markets for CHP

Lets continue to work together to advance the prospects for CHP

Information Clearinghouse and Networking

www.eere.energy.gov/der

- Technical publications
- Workshops and conferences
- Technology planning
- Cost-shared RD&D
- Solicitation announcements

Upcoming CHP Event

www.uschpa.org